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Patent Claims

1. An inorganic scintillating mixture comprising at least a first and a second component each having a characteristic behaviour in response to the irradiation with charged particles, such as protons and heavy ions, showing a typical Bragg peak with respect to a relative depth dose; said first component having a quenching characteristic in the bragg peak region and said second component showing an increased efficiency in the bragg peak region both related to a reference curve for the relative dose.

2. Inorganic scintillating mixture according to claim 1, characterized in that as the first component Gadolinium-Oxy-Sulfid (Gd_2O_2S:Tb) and as the second component Zinc-Cadmium-Sulfid (Zn,Cd)S:Ag is comprised.

3. Inorganic scintillating mixture according to claim 2, characterized in that the content of Gd_2O_2S:Tb is in the range of 60 to 90 %wt and the content of (Zn,Cd)S:Ag is in the range of 10 to 40 %wt.

4. Inorganic scintillating mixture according to claim 3, characterized in that the content of Gd_2O_2S:Tb is in the range of 75 to 85 %wt and the content of (Zn,Cd)S:Ag is in the range of 15 to 25 %wt.

5. An inorganic scintillating mixture comprising at least a first, a second and a third component, whereby the first and the second component having a characteristic behaviour in response to the irradiation with charged particles, such as

protons and heavy ions, showing a typical Bragg peak with respect to a relative depth dose; said first component having a squenching characteristic in the bragg peak region and said second component showing an increased efficiency in the Bragg peak region in comparison to a reference curve for the relative dose and said third component has a binder characteristic in order to hold the first and the second component in a desired mechanical shape.

6. An inorganic scintillating mixture according to claim 5, characterized in that as the first component Gadolinium-Oxy-Sulfid ($Gd_2O_2S:Tb$), as the second component Zinc-Cadmium-Sulfid $(Zn,Cd)S:Ag$ and as the third component an optical cement is comprised.

7. Inorganic scintillating mixture according to claim 6, characterized in that the content of the optical cement is in the range of 20 to 60 %wt, the content of $Gd_2O_2S:Tb$ is in the range of 30 to 60 %wt and the content of $(Zn,Cd)S:Ag$ is in the range of 05 to 30 %wt.

8. Inorganic scintillating mixture according to claim 7, characterized in that the content of the optical cement is in the range of 35 to 45 %wt, the content of $Gd_2O_2S:Tb$ is in the range of 43 to 53 %wt and the content of $(Zn,Cd)S:Ag$ is in the range of 07 to 17 %wt, preferably 40 resp. 48 resp. 12 %wt.

9. Sensor assembly (30) for charged particle dosimetry, such as proton or heavy ion dosimetry, comprising:
a three-dimensional array of sensor heads (12);
each sensor head (12) being located on one end of an optical fibre (16); the opposite end of the optical fibre (16) being associated with an optical light intensity measuring assembly (20);

each sensor head (12) and at least partially its optical fibre (16) are inserted into a respective cavity (42) located in a holder member (22).

10. Sensor assembly (30) according to claim 9, characterized in that the holder member (22) is a substantially cylindrical shaped organic body; said cavity (42) is oriented along its longitudinal axis and has a depth aligned with the desired sensor head's position in said three-dimensional array.

11. Sensor assembly (30) according to claim 9 or 10, characterized in that the holder members (22) are attached in a holder block (32) generating a regular pattern of the sensor heads (12) as seen in a direction parallel to the longitudinal axis of the holder members (22).

12. Sensor assembly (30) according to claim 11, characterized in that the regular pattern is a hexagonal pattern allowing to accommodate the sensor heads (12) relative to its adjacent sensor heads (12) in an equidistantial manner.

13. Sensor assembly (30) according to claim 11 or 12, characterized in that the holder block (32) is related with a stopper member (36) being disposed opposite to the holder block (32) assuring that each tip of the holder member (22) is oriented with a distinct distance from the holder block (32) as seen along the longitudinal axis of the holder member (22).

14. Sensor assembly (30) according to claim 9 to 13, characterized in that the holder member (22) comprises a annular notch (38) being associated with a sealing ring (36) disposed in the holder block (32) or on the notch (38).

15. Sensor assembly (30) according to any of the preceding claims 9 to 14, characterized in that the sensor head (12) has a cylindrical shape and preferably comprises a mixture containing optical cement, Gd_2O_2S:Tb and (Zn,Cd)S:Ag.

16. Sensor assembly (30) according to claim 15, characterized in that the sensor head (12) has a diameter in the range of 1 to 5 mm and a height in the range of 1 to 5 mm.

17. Sensor assembly (30) according to claim 15 or 16, characterized in that the surface of the sensor head opposite to the surface connected to the optical fibre is layered with a reflexion film (44).

18. Sensor assembly (30) according to any of the preceding claims 9 to 17, characterized in that the three-dimensional array is disposed in a cuboid sensor volume in a manner that the sensor head positions are defined in a plane substantially parallel to the (111)-plane in a crystal having a cuboid pattern.

19. Use of a scintillating mixture according to any of the claims 1 to 8 as a component in a phosphor screen in order to avoid quenching correction.

20. Use of a scintillating mixture according to any of the claims 1 to 8, whereby the composition is chosen in order to match a required physical or biological dose model that needs a specific peak-to-entrance ratio so to measure the physical as well as the biological equivalent dose.

21. Use of a scintillating mixture according to any of the claims 1 to 8, in order to gain dose-related data as a basis

for a design or the verification of a therapy model in a medical application, such as intensity modulated proton therapy and intensity modulated heavy ion therapy, such as carbon ion therapy.